

04/07/97

Art Unit: 2213
Examiner: Karlsen. E.

70803 U.S. PTO
08/838452
04/07/97

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner of Patents and Trademarks
Box FWC
Washington D.C. 20231

FILE WRAPPER CONTINUING APPLICATION (FWC) 37 C.F.R. 1.62

- I. This is a request for a filing under the file wrapper continuation application procedure, 37 C.F.R. 1.62 for a continuation of prior complete application Serial No. 08/541,291 filed on October 10, 1995. A Preliminary Amendment is attached hereto. In addition, a Petition For Extension of Time in the prior application is being filed concurrently herewith.

PARTICULARS OF PRIOR APPLICATION

1. Title as originally filed: Bondpad Attachments Having Self-Limiting Properties For Penetration of Semiconductor Die.
2. Name, address and citizenship of applicants as originally filed:

Warren M. Farnworth
2004 S. Banner
Nampa, ID 83686
Citizenship: U.S.

Alan G. Wood
1366 E. Versailles Court
Boise, ID 83706
Citizenship: U.S.

Trung Tri Doan
1574 Shenendoah Drive
Boise, ID 83712
Citizenship: U.S.

David R. Hembree
10855 Smoke Ranch Drive
Boise, ID 83709
3. Application Serial No. 08/541,291 filed October 10, 1995.

The above-identified application, in which no termination of proceedings has occurred, is hereby expressly abandoned as of the filing date of this new application. Please use all of the prior application file wrapper, including the drawings, as the basic papers for the new application.

It is understood that secrecy under U.S.C. 122 is hereby waived to the extent that if information or access is available to any one of the applications in the same file wrapper, the Patent and Trademark Office may provide similar information or access to all the other applications in the same file wrapper.

II. Inventorship Statement

The inventorship for all the claims in this application are the same.

III. Declaration or Oath

This application is a continuation so that a new Declaration or Oath is not required.

IV. Identification of Claims for Further Prosecution

The fees to be charged are to be based on the number of claims remaining as a result of the Preliminary Amendment.

V. Fee Calculation (37 C.F.R. 1.16)

CLAIMS FOR FEE CALCULATION					
	#Filed		#Extra	Rate	Basic Fee \$770.00
Total Claims	12 - 20	=	0	x \$22.00	0.00
Independent Claims	3 - 3	=	0	x \$80.00	0.00

Filing fee calculation..... \$770.00

VI. Fee Payment Being Made at This Time

The filing fee is \$770.00

VII. Method of Payment of Fees

A check in the amount of \$770.00 is enclosed.

VIII. Authorization to Charge Additional Fees

The Commissioner is hereby authorized to charge the following additional fees which may be required by this paper and during the entire pendency of this application to Account No. 07-1857.

Any additional filing fees required under 37 C.F.R. 1.16.

Triplicate copies of this sheet are enclosed.

IX. Instructions as to Overpayment

Credit Account No. 07-1857.

X. Relate Back - 35 U.S.C. 120

Amend the specification by inserting the following cross reference to related application recited in the Preliminary Amendment:

--Cross Reference To Related Applications

This application is a continuation of U.S. Patent Application No. 08/541,291 filed 10/10/95, which is a continuation of U.S. Patent Application No. 08/120,628 filed 9/13/93, abandoned; which is a continuation of U.S. Patent Application No. 08/73,003, filed 6/7/93, abandoned; which is a continuation-in-part of U.S. Patent Application No. 07/709,858, filed 6/4/91, abandoned; and U.S. Patent Application No. 07/788,065, filed 11/5/91, U.S. Patent No. 5,440,240; and U.S. Patent Application No. 07/981,956, filed 11/24/92.

This application is related to U.S. Patent No. 08/406,637 filed 3/30/95.--

XI. Assignment

The prior application is assigned to Micron Technology Inc., 2805 East Columbia Road, Boise, Idaho 83706.

XII. Power of Attorney

The power of attorney in the prior application is assigned to Stephen A. Gratton, Registration No. 28,418. Address all future communications to:

STEPHEN A. GRATTON
10275 Gumbark Place
San Diego, CA 92131
(619) 621-9045

XIII. Abandonment of Prior Application

Please abandon the prior application at a time while the prior application is pending and when this application is granted a filing date so as to make this application co-pending with said prior application.

XIV. Certificate of Express Mail

A Certificate of Mailing by "Express Mail" certifying a filing date of April 7, 1997, by use of Express Mail Label No. EH 983 616 322 US.

DATED this 7th day of April, 1997.

Respectfully submitted:



STEPHEN A. GRATTON
Attorney for Applicants
Registration No. 28,418

10275 Gumbark Place
San Diego, CA 92131
Telephone: (619) 621-9045

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number EH 983 616 322 US
Date of Deposit: April 7, 1997

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Box FWC, Washington, D.C. 20231.

April 7, 1997
Date of Signature



Stephen A. Gratton
Attorney for Applicants

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

WARREN M. FARNWORTH
ALAN G. WOOD
TRUNG TRI DOAN
DAVID R. HEMBREE

Continuation of Serial No.
08/541,291 filed October 10, 1995

Art Unit: 2607

Filing Date: April 7, 1997

Examiner: Karlsen, E.

Title: BONDPAD ATTACHMENTS HAVING
SELF LIMITING PROPERTIES FOR
PENETRATION OF SEMICONDUCTOR
DIE

Attorney Docket No. 91-62.17

TRANSMITTAL LETTER
April 7, 1997

Commissioner of Patents and Trademarks
BOX FWC
Washington, D.C. 20231

Sir:

Transmitted herewith for filing is a FWC application of WARREN M. FARNWORTH, ALAN G. WOOD, TRUNG TRI DOAN, and DAVID R. HEMBREE of prior application Serial No. 08/541,291 filed October 10, 1995 entitled "BONDPAD ATTACHMENTS HAVING SELF LIMITING PROPERTIES FOR PENETRATION OF SEMICONDUCTOR DIE".

Enclosed are the following:

Request for filing a FWC application under
37 C.F.R. §1.60.

A check in the amount of \$770 for the filing fee.

A Certificate of Mailing by Express Mail certifying
a filing date of April 7, 1997 by use of Express
Mail Label No. EH 983 616 322 US.

A Petition for a 60 Day Extension of Time in the
parent case (Serial No. 08/541,291).

A check in the amount of \$360.00 is enclosed for
the fee for the Petition for Extension of Time.

464040-23498830

A Preliminary Amendment dated April 7, 1997 (pages 1-10).

A return postcard.

FILING FEE CALCULATION:

SMALL ENTITY						OTHER THAN A SMALL ENTITY			
CLAIMS REMAINING AFTER AMEND.		HIGHEST NO. PREVIOUSLY PAID FOR		PRESENT EXTRA	RATE	ADD. FEE	OR	RATE	ADD. FEE
BASIC FEE						\$355			\$770
TOTAL	12	MINUS	20	=	0	x11 = \$0		x22	= \$
INDEP.	3	MINUS	3	=	0	x38 = \$0		x80	= \$
TOTAL ADDITIONAL FEE						\$0	OR	TOTAL	\$770

The filing fee is \$770.00

The commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 07-1857, pertaining to i) any filing fees under 37 CFR 1.16 for the presentation of extra claims; ii) any patent application processing fees under 37 CFR 1.17. Copies in triplicate of this sheet are enclosed.

DATED this 7th day of April, 1997.

Respectfully submitted:



STEPHEN A. GRATTON
Registration No. 28,418
Attorney for Applicants

10275 Gumbark Place
San Diego, CA 92131
Telephone: (619) 621-9045

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number EH 983 616 322US

Date of Deposit: April 7, 1997

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, BOX FWC, Washington, D.C. 20231.

April 7, 1997
Date of Signature

Stephen A. Gratton
Stephen A. Gratton, Registration No. 28,418
Attorney for Applicants

2040-2548880

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Warren M. Farnworth
Alan G. Wood
Trung Tri Doan
David R. Hembree

Art Unit: 2607

Continuation of Serial No.
08/541,291 filed October 10, 1995

Filing Date: April 7, 1997

Examiner: Karlsen, E.

Title: BONDPAD ATTACHMENTS HAVING
SELF LIMITING PROPERTIES FOR
PENETRATION OF SEMICONDUCTOR
DIE (as amended)

Attorney Docket No.: 91-62.17

PRELIMINARY AMENDMENT
April 7, 1997

Honorable Commissioner of Patents and Trademarks
Box FWC
Washington D.C. 20231

Sir:

This Preliminary Amendment is filed with a file wrapper continuing application (FWC) under 37 C.F.R. §1.62. This Preliminary Amendment is in response to the final Office Action dated November 5, 1996 (Paper No. 22) having a statutory period for response set to expire on February 5, 1997 but extended for 2 months until April 7, 1997. Please amend the captioned case as follows.

In the specification

On page 1, please cancel the Cross Reference to Related Applications contained in the Preliminary Amendment dated October 10, 1995 and substitute the following:

--Cross Reference To Related Applications

This application is a continuation of U.S. Patent Application No. 08/541,291 filed 10/10/95, which is a

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continuation of U.S. Patent Application No, 08/120,628 filed 9/13/93, abandoned; which is a continuation of U.S. Patent Application No. 08/73,003, filed 6/7/93, abandoned; which is a continuation-in-part of U.S. Patent Application No. 07/709,858, filed 6/4/91, abandoned; and U.S. Patent Application No. 07/788,065, filed 11/5/91, U.S. Patent No. 5,440,240; and U.S. Patent Application No. 07/981,956, filed 11/24/92.

This application is related to U.S. Patent No. 08/406,637 filed 3/30/95.--

On page 9,

line 10, after "bondpad" add--by at least 5000Å,--.

On page 17,

line 14 delete "_____ (s.n. 7/898,624), for" and substitute --Application serial no. 7/898,624, entitled--.

On page 23,

line 13, delete "Serial No. 8/46,675 filed May 14, 1993," and substitute --No. 5,367,253,--;

line 15, delete "application".

In the claims

Please cancel claims 83, 89, 94 and 95.

78. (twice amended) An attachment member for making electrical connections for testing [discrete,] unpackaged semiconductor dice, said attachment member comprising:

a substrate for mounting within a test apparatus configured to retain the substrate and a single die and to bias the die against the substrate with a selected contact force;

a contact formed on the substrate including a plurality of raised portions projecting from a surface of the contact

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[and dimensioned to penetrate into a recessed, metal bondpad on the die,] said raised portions dimensioned to penetrate into a pad on the die at the selected contact force with a penetration depth equal to a height of the raised portions but less than a thickness of the pad [to a penetration depth that is less than a thickness of the bondpad] while the surface of the contact limits further penetration of the contact into the pad at the selected contact force; and

a conductive trace formed on the substrate in electrical communication with the contact.

79. (twice amended) The attachment member as claimed in claim 78 [and] wherein the substrate and contact comprise silicon. [are formed of a material selected from the group consisting of silicon, germanium, silicon on sapphire, silicon on glass and a ceramic.]

80. (twice amended) The attachment member as claimed in claim 78 [and] wherein the raised portions comprise points. [are formed as pointed members.]

81. (twice amended) The attachment member as claimed in claim 78 [and] wherein the raised portions have a height of about 5000Å.

82. (twice amended) The attachment member as claimed in claim 78 [and] wherein the pad comprises a bondpad [is] recessed within a passivation layer formed on the die.

87. (amended) A member for making electrical connections for testing [discrete] unpackaged semiconductor dice, said member comprising:

a substrate for mounting within a test apparatus configured to retain a single unpackaged die and to bias the die against the substrate with a selected contact force;

a contact formed on the substrate including a plurality of raised portions projecting from a surface of the contact, said raised portions shaped and dimensioned to penetrate into a [recessed metal] bondpad on the die at the selected contact force with a penetration depth equal to a height of the raised portions but less than a thickness of the bondpad [on the die to a penetration depth that is less than a thickness of the bondpad] while the surface of the contact limits further penetration of the contact into the bondpad at the selected contact force; and

a conductive trace formed on the substrate in electrical communication with the contact.

88. (amended) The member as claimed in claim 87 [and] wherein the raised portions have a height of [about] at least 5000Å.

90. (amended) The member as claimed in claim 87 [and] wherein the substrate and contact comprise silicon. [are formed of a semiconductor material.]

91. (amended) The member as claimed in claim 87 [and] further comprising a second bond pad [formed on] in electrical communication with the conductive trace for wirebonding to the conductive trace.

92. (amended) A member for making temporary electrical connections for testing [discrete,] unpackaged semiconductor dice, said member comprising:

a substrate for mounting within a test apparatus configured to retain a single unpackaged die having a [recessed metal] bondpad and to bias the die and the substrate together with a selected contact force therebetween;

a contact formed on the substrate including a plurality of raised portions projecting from a surface of the contact,

said raised portions shaped and dimensioned to penetrate into the bondpad at the selected contact force by a penetration depth equal to a height of the raised portions but less than a thickness of the bondpad [having a height of about 5000Å, said raised portions configured to penetrate into the bondpad to a limited penetration depth] while the surface of the contact limits further penetration of the contact into the bondpad at the selected contact force; and

a conductive trace formed on the substrate in electrical communication with the contact.

93. (amended) The member as claimed in claim 92 [and] wherein the substrate and contact comprise silicon. [are formed of a semiconductor material.]

96. (amended) The member as claimed in claim 92 [and] wherein the raised portions comprise points. [are pointed].

Remarks

Restriction

Applicant elects the species of a silicon substrate and contact. Claims 78-82, 87, 88, 90-93 and 96 are readable on the elected species. Claims 83, 89, 94 and 95 have been canceled.

Rejections Under 35 USC §112

Claims 78-82, 87, 88 90-93 and 96 have been rejected under 35 USC §112, first paragraph, due to the recitations of "recessed metal bond pad", "pointed members" and a "height of about 5000Å". These rejections are respectfully traversed.

Antecedent basis for the term "recessed bondpads" is contained on page 7, lines 19-20; on page 15, lines 18-20; on page 19, line 20; and in Figures 4-6. The term "metal" has been deleted.

The term "pointed member" has been changed to "point". Antecedent basis for "point" is contained on page 9, line 9, and in Figures 4-6.

The term "5000 Å" was originally recited on page 28, line 11, of claim 4. This term has been added to the specification at page 9, line 10 to provide antecedent basis in the claims. Since it was originally disclosed in the claims no new matter has been added.

Rejections Under 35 USC §103

Claims 78-82, 87, 88, 90-93 and 96 have been rejected under 36 USC §103(a) over Elder in a first set, in view of Nakano in a second set, and Blonder et al., Bindra et al. or Anschel et al. in a third set. Claims 78-82, 87, 88, 90-93 and 96 have been rejected under 35 USC §103(a) over Nakano et al. in view of Blonder et al., Bindra et al. or Anschel et al. in a second set.

In response to the §103 rejections, independent claims 78, 87 and 92 have been amended. The amended independent claims define an attachment member adapted for placement in a test apparatus for "a single die". This type of test apparatus is also referred to in the art as a "carrier" or "temporary package". Representative test apparatus are shown in Figures 1, 8, 9, 10 and 11 of the present application. In addition, page 23, line 14 of the specification, incorporates by reference the test apparatus of U.S. Patent No. 5,367,253 (copy attached).

With this type of test apparatus the die and a "substrate" of the attachment member are biased together with a "selected contact force". This feature is now recited in each independent claim. Antecedent basis for "contact force" is provided on page 17, line 27 of the specification, and on column 9, line 39, of the '253 patent incorporated by reference.

To make a reliable electrical connection, the contact force must be sufficient to allow the contact (43-Figure 1)

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on the substrate (41-Figure 3) to penetrate an oxide layer covering the device bondpad (see column 9, lines 39-44 of incorporated patent). At the same time, damage to the bondpad and to the die are preferably minimized so that the bondpad does not require re-working. The present invention accomplishes this result by relating the shape and dimensions of the contact to the contact force exerted by the test apparatus. The penetration depth of the contact into the bondpad is thus controlled to insure penetration, but with limited damage to the bondpad.

As shown in Figure 6, and described on page 17, lines 19-30 of the present specification, the raised members 73 are "dimensioned to penetrate into the bondpad by a penetration depth equal to a height of the raised members but less than a thickness of the bondpad". This is accomplished at a "selected contact force" between the die and substrate (i.e., biasing force). However, at the same time a "surface" of the "contact" limits "further penetration" of the "contact" into the bondpad at the "selected contact force".

Each of the independent claims include the above quoted recitations. It is submitted that the cited prior art does not teach or render these features as obvious.

The Elder et al. reference describes a test apparatus that includes contact bumps 24 (Figure 3). As shown in Figure 6 of Elder et al., these contact bumps 24 are pressed into contact with the die 21 by the compression of the elastomer 25 in the assembled socket (col. 4, line 32). In Elder et al. there is no teaching of a penetrating contact. In addition there is no teaching of limiting the penetration depth into the die 21 using the shape and dimensions of the contact bumps 24. Still further, there is no teaching of relating the shape and dimensions of the contact bumps 24 to the contact force exerted by the test apparatus.

The combination of Nakano with Elder et al. also does not suggest "penetration limitation" at a "selected contact force". As previously argued, Nakano is a probe card. With

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a probe card a wafer handler presses the probe card against the wafer. The contact forces between the probe card and the wafer can be controlled as required, by adjustments to the wafer handler. On the other hand, with the presently claimed "test apparatus for a single unpackaged die", the contact force must be generated without external control of the test apparatus. Once the test apparatus is assembled with the force applying mechanism (e.g., clamp 89-Figure 11 of present specification), the contact force cannot be varied.

However, the present invention achieves control by forming the "contacts" with "raised portions" adapted to "penetrate" into the bondpad at the "selected contact force". At the same time, the contact includes a surface that limits further penetration at the "selected contact force".

The Nakano contact is a penetrating contact and thus appears similar in structure to the present contact. However, Nakano does not consider the relationship of the contact to the contact force in an assembled test apparatus. Furthermore, the Nakano contact are proportioned and dimensioned such that they could not function in the manner presently claimed. As previously argued, the Nakano protuberances 21 are 10 μ m in height (page 5, last paragraph). The probe contacts 22 appear to be similarly sized. Probe contacts 22 sized in this manner could only be used with a thick film pad 25. A thick film pad 25 is not as fragile as a thin film bondpad, some of which are only 1 μ m or less in thickness. The object in Nakano is to penetrate the pad 25, and not to limit penetration depth as a function of "contact force" as presently claimed.

Still further, the present claims recite "a plurality of raised portions" rather than one single probe contact as in Nakano. With multiple raised portions, current can be spread out, while damage can be limited by the dimensions of the raised portions. With one probe contact as in Nakano, the contact would need to be larger to carry the current. However, a larger contact causes more damage to the die.

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The Blonder et al. reference is a permanent connection system that requires "bonding of the carrier pads to the chip pads" (col. 2, lines 40-41). Blonder et al does not relate contact force to penetration depth. Rather as explained in column 4, lines 49-55 of Blonder et al., an external mechanical pressure is applied to the chips and carrier. Again this pressure can be mechanically controlled, and a special contact structure to limit the penetration depth as a function of contact pressure is not required.

The Bindra et al. reference describes a separable electrical connection technology that uses interdigitating members 62. Figure 20 illustrates the mechanical connection of the interdigitating members 62 to a solder ball 61. As stated at column 8, lines 37-38 of Bindra et al. a "pressure insertion" is employed. Presumably this pressure could be selected as required, and "penetration limitation at a selected contact force" would not be a consideration with this reference.

The Anshel et al reference has a filing date of June 11, 1993. The present application is a continuation with a priority date of at least June 4, 1991. Accordingly, Anshel et al. is not a proper reference under 35 USC §103.

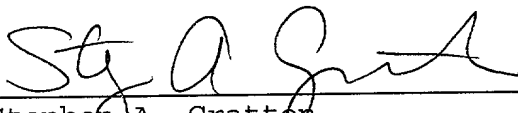
In addition to the differences between the references and the present invention, Applicants would argue that one skilled in the art would not combine the references in the manner of the Office Action to provide "more reliable contact" (page 5, first paragraph of final Office Action). Admittedly, test apparatus for single dice as disclosed by Elder et al. are known in the art. In a similar manner, penetrating contact structures for device bondpads as disclosed by Nakano, Blonder et al. and Bindra et al. are known in the art. However, the Elder et al. reference states at column 4, lines 32-33 that "The compression of elastomer 25 provides slight scrubbing action which is necessary for good electrical contact". If the reference teaches that the

contact is already good with a scrubbing action, there would be no incentive for improvement using a penetrating contact.

In view of the amendments and arguments, claims 78-82, 87-88, 90-93 and 96 are submitted to be in a condition for allowance and such an action is requested. Should any other issues remain, the Examiner is asked to contact the undersigned by telephone.

DATED this 7th day of April, 1997.

Respectfully submitted:



Stephen A. Gratton
Registration No. 28,418
Attorney for Applicants

10275 Gumbark Place
San Diego, CA 92131
Telephone: (619) 621-9045

*Enclosure: Petition for 60 Day Extension
U.S. Patent No. 5,367,253*

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number EH 983 616 322 US
Date of Deposit: April 7, 1997

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Box FWC, Washington, D.C. 20231.

April 7, 1997

Date of Signature



Stephen A. Gratton
Attorney for Applicants